



Role of Free Radicals and Antioxidants in Health and Disease

Over the past few decades, free radicals, highly reactive and thereby destructive molecules, are known increasingly for their importance to human health and disease. Many common and life threatening human diseases, including atherosclerosis, diabetes, cancer, and aging, have free radical reactions as an underlying mechanism of injury. Because our body is continuously exposed to free radicals and other ROS, from both external sources (sunlight, other forms of radiation, pollution) and generated endogenously, ROS-mediated tissue injury is a final common pathway for a number of disease processes. Radicals of oxygen (superoxide anion, hydroxyl radical, and peroxy- radicals), reactive non-radical oxygen species such as hydrogen peroxide and singlet oxygen, as well as carbon, nitrogen, and sulfur radicals comprise the variety of reactive molecules that can cause damage to cell. Our conceptual understanding of the interaction of such reactive oxygen species (ROS) with living organisms has undergone a remarkable evolution.

Antioxidants are intimately involved in the prevention of cellular damage - the common pathway for cancer, aging, and a variety of diseases. These molecules safely interact with free radicals and terminate the chain reaction before vital molecules are damaged. They neutralize free radicals by donating one of their own electrons. The antioxidant nutrients themselves don't become free radicals by donating an electron because they are stable in either form; they act as scavengers, helping to prevent cell and tissue damage that could lead to cellular damage and disease. Although there are several enzyme systems within the body that scavenge free radicals, the principle

antioxidants are vitamin E, vitamin C, n-acetylcysteine and α -lipoic acid. The vitamins C and E are thought to protect the body against the destructive effects of free radicals. Additionally, selenium, a trace metal that is required for proper function of one of the body's antioxidant enzyme systems, is also included in this category.

After having a very successful symposium during the Fourth World Congress on Cellular and Molecular Biology held at Poieters Prof. Maixent and I decided to have a special issue of *Cellular and Molecular Biology* covering the different topics related to role of free radicals in different human diseases/poisonings and possible effects of antioxidants. We included reviews and free papers covering the patho-biology of free radicals in a wide range of diseases afflicting large section of population such as diabetes, cardio-vascular diseases; some others would focus on fundamental aspects. There are research articles that would also delve into the progress made by toxicologists.

The first article of the first issue by Ray et al. focuses on some of the current areas of nitric oxide (NO) research, recent understanding on the novel actions of this molecule, state of the art in developing drugs that works through NO and speculate on future research directions. The second article by Korkina describes the metabolic pathways of phenylpropanoid biosynthesis in plants and the mechanism of phenylpropanoid-mediated plant defense. Third article by us provides comprehensive information about the role of oxidative stress in lead and arsenic toxicity and possible remedial measures (i.e. role of

antioxidants and chelating agents). After these three review papers there are number of original research papers. The first paper by Sharma et al. provides information that N-acetyl cysteine (NAC), attenuates 1-methyl 4-phenyl-1, 2, 3, 6 tetrahydropyridine (MPTP) neurotoxicity in mice brain and this protection by the NAC might be contributing to the regeneration of GSH, a major antioxidant. The study by Yang et al shows that intracellular redox state may not be an important cause of the metal induced cytotoxicity but a depletion of GSH may enhance metal toxicity. Kostyuk et al. suggested the crucial role of oxidative stress in Thioacetamide-induced hepatotoxicity and also suggest protective effect of rutin-iron complex. An interesting study by Husain suggested that chronic ethanol ingestion induces aortic endothelial oxidative injury and the down regulation of nitric oxide generating system leading to impaired vasorelaxation and hypertension in rats. An important finding by Zoltani and Baskin reported that control of the swelling and protein kinase C (PKC)-activated chloride currents can limit the electrical chaos of pharmacologically-caused hypoxic cardiac toxicity. Chatterjee et al. investigated the NO/NOS status and superoxide radical generation from neutrophils in spontaneously hypertensive rats to assess the role of neutrophils and oxidative stress in hypertension and suggested that macrophages can possibly play a role in target organ damage during hypertension as they do in sepsis. An important contribution by De Luca et al. suggested that pre- and post oral administration with selected antioxidants (RRR-a-tocopherol, coenzyme Q₁₀) potentiating antioxidant defence system, coupled with enhancers of a specific immune defense (soy phospholipids, L-methionine), is beneficial to skin healing and trophism. The last article of the first issue by Bhadauria et al. studied the cytotoxic effect Isoniazid (INH) in hepatoma cell line (Hep-G2).

Thus the special issue provides valuable information for researchers working in the area of oxidative stress and antioxidants. I sincerely thank all contributors for submitting their

manuscripts in a timely manner and working diligently with the editors. I would also like to thank my two co-editors, Dr (Mrs.) Madhu Dikshit and Dr Govinder Flora for providing me whole hearted support in the review process and Dr. R. Vijayaraghavan, Director, Defence Research and Development Establishment, Gwalior, India for his co-operation and support. We also thank Prof. Maixent and Prof. Wegmann for giving us an opportunity to contribute two special issues of Cellular and Molecular Biology on the above theme and also all the staff (particularly Mourad FARES) for their support and co-operation.

**Dr. S.J.S. Flora
Guest Editor**